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स्मार्ट कम्युनिटी इन्फ्रास्ट्रक्चर — कॉम्पैक्ट  
शहरों के लिए स्मार्ट परिवहन —  
दिशानिर्देश

Smart Community  
Infrastructures — Smart  
Transportation for Compact  
Cities — Guidelines

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## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Smart Cities Sectional Committee had been approved by the Civil Engineering Division Council.

A compact city is an urban design concept that invites people back to a small area in a city where the population has decreased or is decreasing. Model shifts of passengers from public to private transportation have resulted in people moving out of the city centre into the suburbs, since private transportation enables movement without dependent time schedules and fixed routes. The problems associated with public transportation are mainly related to station or stop intervals, service frequency, approaches to station/stops and service routes and networks. Furthermore, large-scale shopping malls and hospitals are frequently constructed outside cities. Such a situation accelerates the outflow of residents, resulting in the de-urbanization of city centres. Downtown, the public realm and community safety fall into decline, causes more people to move out to the suburbs. This negative spiral continues, changing the character of a city.

One way to pre-empt the deterioration of a city centre is through the creation of a compact city. The concept behind compact cities is that facilities for citizens, such as shopping malls, offices and hospitals, are placed in a small targets areas. These facilities are connected to one another by short-interval, high-frequency public transportation which can be easily accessed by citizens. Additionally, this type of transportation reconnects citizens living in the suburbs to the urban centre, with service lines laid radially in relation to the suburbs surrounding the area. This transportation network successfully attracts people into a target area from its periphery and retains them therein. This is a solution to the problem of declining city centres, utilizing smart transportation to resuscitate small down town areas.

This standard describes a way to organize smart transportation to create a compact city that regenerates a declining urban centre and rejuvenates its economic, physical and social infrastructure. This standard also aims at satisfying some Sustainable Development Goals by United Nations, especially Goal 3 ‘Good health and well-being’, Goal 7 ‘Affordable and clean energy’, Goal 8 ‘Decent work and economic growth’, Goal 9 ‘Industry, innovation and infrastructure’, Goal 11 ‘Sustainable cities and communities’, Goal 13 ‘Climate action’ and Goal 15 ‘Life on land’.

In the preparation of this standard, assistance was derived from ISO 37157 : 2018 ‘Smart community infrastructures — Smart transportation for compact cities’.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

# SMART COMMUNITY INFRASTRUCTURES — SMART TRANSPORTATION FOR COMPACT CITIES — GUIDELINES

## 1 SCOPE

**1.1** This standard describes criteria to help plan or organize smart transportation for compact cities. It is intended to apply to cities facing an urban sprawl and infrastructure crunch.

**1.2** Urban sprawl is a resultant of an ever-expanding city jurisdiction due to absence of compact development practices. This has resulted in undesirable extension of urban infrastructure, encroachment of valuable agricultural land, raising cost of development and also increasing carbon, water and energy footprints. Smart transportation can be applied to encourage compact city development.

**1.3** This standard shall be read in conjunction with IS 17451.

## 2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

| <i>IS No.</i>   | <i>Title</i>                                                                     |
|-----------------|----------------------------------------------------------------------------------|
| IS 17451 : 2020 | Smart community infrastructures — Best practices for transportation — Guidelines |
| IS 17457 : 2020 | Sustainable development of habitats — Vocabulary                                 |

## 3 TERMS AND DEFINITIONS

For the purpose of this standard, the terms and definitions given in IS 17451, IS 17457 and the following shall apply.

**3.1 Compact City** — City where the majority of facilities and amenities that support life for citizens are accessible within a radius of approximately 1 km.

The concept of compact city revolves around high-density development without compromising the quality of life of the people. This approach

largely solves the problem of externalities such as friction on space (congestion), travel time delays and losses in economic productivity, air and water pollution, solid waste collection and disposal. The optimum density reduces the capital and operating costs of providing public infrastructure and services and improves overall accessibility.

NOTE — Such facilities and amenities would generally include those that support employment, shopping and commerce, medical and educational needs and cultural activities.

**3.2 Headway** — Amount of time between transit vehicles arriving at the station.

**3.3 Light Rail Transit (LRT)** — Transportation system using trams or rolling stock.

**3.4 Automated Guideway Transit (AGT)** — Automated operation-applicable transportation system using polymer tyre-supporting rolling stock equipped with guide wheels contacting guide rails for steering.

NOTE — Typical AGT service lines are Bukit Panjang LRT in Singapore, Port Liner in Kobe, Japan, and MIA Mover in Miami International Airport, USA.

## 4 CONCEPTS OF SMART TRANSPORTATION FOR COMPACT CITIES

### 4.1 General

The facilities of a compact city should be connected by transportation systems that provide a high frequency of service and are easily accessible. In addition, the transportation systems stations or stops should be located at close intervals, and serviced by vehicles that can successfully start and stop at short intervals. These vehicles need not necessarily be high capacity. Such specific transportation systems provide people living in the suburbs with easy access to the target area and encourage them to stay therein. By using these transportation systems, the target area begins to be repopulated.

### 4.2 Applicable City Issues

The criteria for smart transportation described in this standard are appropriate for addressing the issue of urban sprawl and infrastructure pressured within a city where the goal is to curb the sporadic urban expansion.

## 5 ADOPTION OF SMART TRANSPORTATION FOR COMPACT CITIES

### 5.1 Objectives

As mentioned in 4.2, smart transportation as described in this standard can help address the issue of urban sprawl and encourage compact city development.

To help achieve this goal, transportation modes which meet the conditions described in 5.2 should be selected.

### 5.2 Selection of Transportation Modes

#### 5.2.1 General

Transportation modes which provide transportation services meeting the conditions specified from 5.2.2 to 5.2.12 should be selected.

NOTE — Mass rapid transit system (MRTS), bus rapid transit system (BRTS), rapid rail transit system (RRTS), commuter rail, light rail transit (LRT), buses and automated guide way transit (AGT) are typical transportation modes that foster the development of compact cities.

#### 5.2.2 Service Frequency

The transportation service should be provided at adequate headway to ensure minimum waiting time for passengers.

NOTE — Normally, the higher the population density and expected passenger numbers, the higher the service frequency that would be needed.

#### 5.2.3 Station/Stop Interval

Stations or stops should be placed so that the average distance between them is 1 km to 1.1 km, except when it is hard to place stations or stops at this distance due to geographical or traffic conditions or specific local situations.

NOTE — Typical exemptions include smart transportation routes on bridges or in tunnels.

#### 5.2.4 Coach Convenience, Ride Comfort and Safety

Entry and exit from the transportation vehicle should be easy and accessible for all, including the persons with disability (PwD), elderly, children and people with small children. Users with disabilities should be able to enter and exit with minimal or no assistance. Vehicles should provide a comfortable ride for all, including the elderly, children and those with disabilities, with little vibration or noise. Where appropriate, vehicles should be air-conditioned. Vehicles can also include space for bicycles, wheelchairs or other large items.

Vehicles should be equipped with wheelchair ramps, handrails, handgrips, hanging straps and non-slip floors for safety, and there should be easy communication channels, especially with a dispatcher, in case of emergency.

NOTE — Battery-powered buses provide comfort, and are widely used, because no gear changes are needed, meaning no sudden shocks.

#### 5.2.5 Geographical Applicability

Suitable transportation systems should be used in accordance with the geographical and meteorological conditions they will operate in.

Often, the target area to be developed as a compact city used to be the city centre, with narrow, winding streets. The transportation system should be suitable even in such conditions.

#### 5.2.6 Running Performance

Vehicles should have acceleration high enough to ensure time saving for travel on such a service line with stops/stations at short intervals.

#### 5.2.7 Exclusive Tracks

Tracks and/or dedicated street lanes should be placed in service for use by the smart transportation system only.

#### 5.2.8 Promotion of Environmentally Friendly Vehicles and Life-Cycle Performance

Transportation systems which produce low chemical emissions, vibration and noise levels should be used. Furthermore, positive application of technologies should be promoted to develop environmentally friendly vehicles and enhance the life-cycle performance of the transportation.

NOTE — For example, to promote environmentally friendly performance, many cities across the world have introduced battery-powered buses, which produce no CO<sub>2</sub>, NO<sub>x</sub>, SO<sub>x</sub> or PMs. An example of a successful trial is given in Annex A.

#### 5.2.9 Improvement of Land Reuse

Transportation modes which allow for the reuse of compact city land for any kind of facilities that do not have a chemical or geological impact should be used.

#### 5.2.10 Energy Saving

Transportation systems which can save energy by, for example, using recovered braking energy, minimizing energy consumption, optimizing operation schedules or controlling vehicle running performance should be used.

### 5.2.11 Information Provision

Information should be provided to customers on transport operation through signage and web applications (for example, displays for passengers indicating bus/train final destinations, service routes, stops/stations, estimated arrival time and available wi-fi networks).

### 5.2.12 Rider Fees

Where the service is fare-based, transportation systems should provide an electronic-based payment system that interacts and integrates with those of other public transportation systems in the area.

## 5.3 Installation of Smart Transportation

By using the transportation modes selected, a smart transportation system should be set up to meet the conditions described in 5.2.

## 6 MAINTAINING THE QUALITY OF SMART TRANSPORTATION FOR COMPACT CITIES

### 6.1 General

To maintain the performance and monitor the effectiveness of smart transportation in compact cities, observe the parameters in 6.2 periodically. If the effectiveness of smart transportation cannot be confirmed, modify the current smart transportation

services by changing the conditions detailed in 5.2, where possible and reasonable.

### 6.2 Parameters to be Observed

To maintain the performance of smart transportation, observe the following parameters:

- a) Population in the target area where smart transportation was installed;
- b) Traffic flow from/to the target area;
- c) The modal split of smart transportation in the target city/area;
- d) The required capacity of smart transportation; and
- e) City axes of the target city.

These parameters have been developed based on proven measures for transit performance.

### 6.3 Modification of Smart Transportation

When unwanted changes in the value of the parameters in 6.2 are identified, modify the conditions of smart transportation, as detailed in 5.2, where possible. To correct the transportation parameters, analyse any unexpected or irregular occurrences in the area where smart transportation was installed. Modify the irregular conditions of the smart transportation system if these are not acceptable.

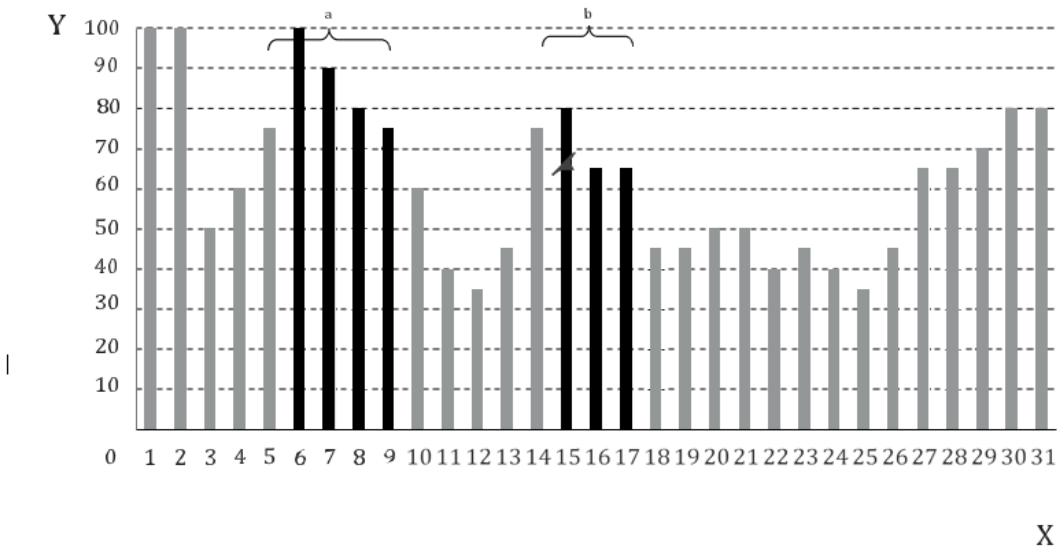
ANNEX A

(Clause 5.2.8)

TRIALS GIVEN BY PARIS CITY IN DECEMBER 2016 TO SUPPRESS AIR POLLUTION BY INVITING CITIZENS USING ENGINE-DRIVEN VEHICLES TO ELECTRICALLY OPERATED TRANSPORTATION SERVICES

**A-1** To observe changes in air pollution in the greater Paris area, France, Paris city and 22 communities surrounding the city attempted to limit the use of engine-driven vehicles by offering free public transportation (mostly electrically operated trains and buses) to local residents. Trials

were carried out twice in December 2016. During the trials, citizens drastically shifted from engine-driven vehicles to electric transportation. As a result, the air pollution in Paris was reduced during and after the trials, as shown in Fig. 1.



Key

- X date in December 2016
- Y City air index
- a First trial
- b Second trial

NOTE — Air pollution is indicated with a cite air index or a traffic and air pollution indicator as a mix index.

FIG. 1 SUPPRESSION IN AIR POLLUTION IN PARIS DURING TRIALS OF THE SHIFT FROM ENGINE DRIVEN VEHICLES TO ELECTRIC TRANSPORTATION

**ANNEX B***(Foreword)***COMMITTEE COMPOSITION**

Smart Cities Sectional Committee, CED 59

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